The Knowledge Bank at The Ohio State University

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BUILDING THE OHIO STADIUM

By W. S. HINDMAN, *Field Engineer.*

NO DOUBT since the dedication of the Stadium on October 21st last, those who were fortunate enough to be present at that great gathering and those who have read or heard about it will be somewhat interested in knowing about a few of the engineering problems encountered in its construction. In carrying out this great program it has been the constant aim of the engineers and architects to secure for Ohio State University a permanent structure conforming to the most modern engineering and architectural practice, and it is now for the general public to judge how well this object has been carried out. It has been the writer's privilege to listen to many comments by visitors to the Stadium as to the strength of various structural members of which it is composed, but we feel that any doubts which may have existed in this respect should be entirely eliminated after a test load such as that during the dedication has been applied without developing a sign of weakness in any respect.

LOCATION.

The main axis of the Stadium is located on a line running approximately north and south and bisecting the area between the old agriculture buildings and the Olentangy River on a tract of ninety acres set aside by the University Trustees for athletic purposes. The north end of the structure is 450 feet south of the present Hocking Valley track or University spur.

In order to determine the proper elevation of the playing field and general floor level of the Stadium, cross-sections were taken at 25-foot intervals over the entire area covered by the Stadium and its surroundings. From these it was decided to use an elevation of 724.00 above sea level or about 10 feet above low water level in the river. This has required filling to the amount of about 60,000 cubic yards, 25,000 of which is under the playing field and the balance under and around the structure.

The playing field was filled to within four feet of the required grade with cinders and the balance of the fill of top soil taken from under the east side of the Stadium. The finished field is in the form of a turtle back crowned one foot in the center and is underlaid with four-inch drain tile.

GENERAL DESCRIPTION.

The Stadium is in the shape of a horseshoe with bowed sides and has the distinction of being the first double deck structure of this type to be built; also the first to be designed with a view of utilizing the space underneath for athletic purposes.

It is approximately 760 feet long on the main axis and 600 feet wide out to out, 148 feet front to rear and 98 feet high to top of rear wall, with the towers about 112 feet above foundations. Each leg of the horseshoe is terminated with a tower approximately 36 by 60 feet and at the center of the north end are two towers 36 feet square connected by a 68-foot arch with the crown 85 feet 6 inches above the floor of the

By courtesy The Alumni Monthly.

View showing the West Wing of the Stadium during the Michigan game, when a crowd of more than 70,000 gave it its test.

main entrance and behind which is a half dome. In the south towers are located the athletic offices, team rooms, locker and shower rooms, and in the north towers the ticket offices, rest rooms and projecting rooms.

Approximately 30,000 cubic yards of concrete, 4300 tons of structural steel and 1200 tons of reinforcing steel have been used in the construciton, in addition to about 1,500,000 feet of form lumber. There are about 21 miles of seats which will accommodate approximately 63,000 people. Of these about 3,000 are box seats.

Entrance to the structure will be thru a number of the 78 outside arches at which turnstiles will be placed in addition to the main entrance at the north end. Each of these at present will be closed with a four-leaf iron gate so that as many as necessary may be used. At six points on either side, the arches are filled in, which serves the twofold purpose of adding to the architectural effect and concealing the points of vertical circulation. An important feature of the Stadium is that it contains twenty public comfort stations, eight for women and twelve for men, not including the ones in the south tower.

Much time and thought was given to the circulation problem, particularly to handling the people who occupy the rear portion of the lower deck and all of the upper deck seats. This has been solved by constructing at six points on either side of the Stadium a combination of ramps and stairs leading up to the lower circulating gallery at the forty-foot level and from this a series of stairs and landings to a second gallery at the sixty-seven-foot level. From both of these galleries short easy ramps lead to the portal openings in the seat banks. The lower ramps are partially suspended by steel hangers from the steel trusses thru which they pass in order not to obstruct the space underneath with columns.

LAYING OUT.

A very interesting problem was presented in the staking out of this unusual structure, since all points of support are located on curves having long radii and the actual curve centers were not available to work from. It was necessary to have this work accurately done in order that the structural steel work would fit up properly. All points were located by means of a system of co-ordinates from two base-lines established 350 feet on either side and parallel to the main north and south axis. In establishing these base-lines it was found necessary to calibrate the steel tape used, which was done by comparing it with a standard tape. All measurements were taken with the tape level and a pull of twenty pounds applied by means of a spring balance after which a temperature correction was applied. The results obtained were very satisfactory and no trouble was experienced during the construction from misplaced foundations.

FOUNDATIONS.

All foundations rest on a layer of gravel which underlies the structure at a varying depth of from 3.5 to 4 feet on the east side to about 14 feet on the west side below the established floor level. In order to determine the underlying strata twenty test holes were drilled on the site and samples were taken every foot, the results being plotted on a drawing which was a part of the contract set. Only three of these holes were drilled to rock which is from 50 to 60 feet below the surface. All foundations are designed with spread footings and thoroughly reinforced with steel rods. On account of the foundations on the west side being below the water level of the river it was necessary to drive sheeting and pump the water out, the pumping being done principally with electrically driven centrifugal pumps.

CONTRACTOR'S PLANT.

Since nearly all material used had to be delivered by the railroad, a standard gage track was laid from the University track at the north and extending around the east side to a point several hundred feet south of the Stadium. Along this track is located the concrete mixing

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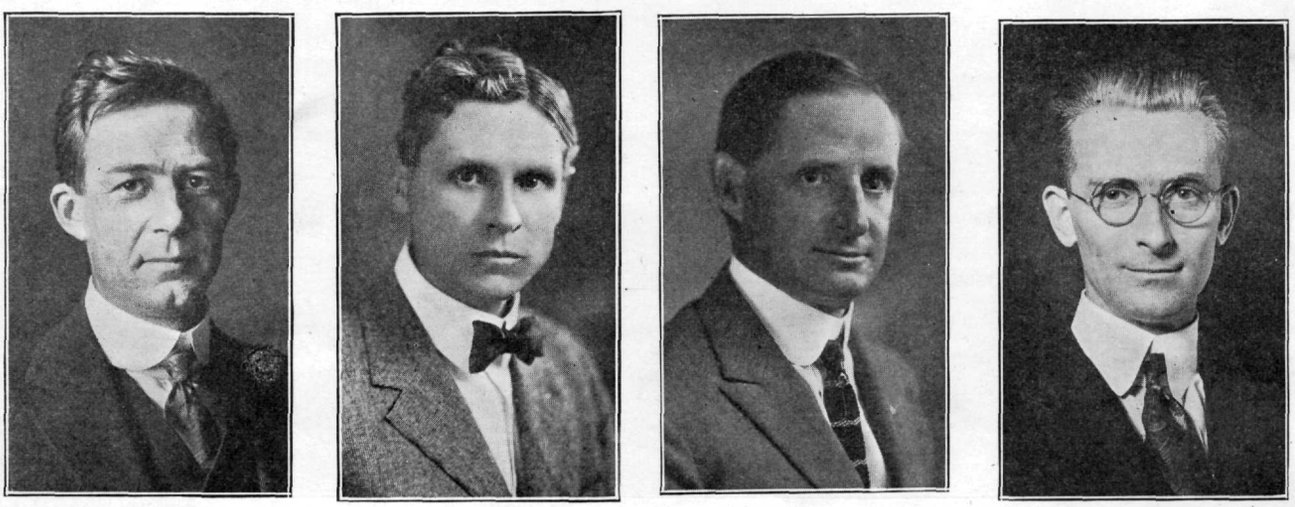

THE BUILDERS By courtesy University News Service.

Left to right they are: E. H. Latham, contractor; C. T. Morris, chief engineer; W. S. Hindman, field engineer; H. D. Smith, architect.

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plant, saw mill, and storage yards. A standard gage track was laid 25 feet in from the outside wall and extending the entire distance around the structure, on which a locomotive crane was operated to do the major part of the excavation by means of a clamshell bucket and to handle all the concrete used in the foundation. From the same track a locomotive crane was used by the Mt. Vernon Bridge Company to erect all the structural steel. All concrete was mixed at a central mixing plant and transported in buckets of one cubic yard capacity on a narrow gage industrial railway located about 10 feet outside the structure and operated with gasoline locomotives. On top of the steel framework four traveling derricks were built which handled the concrete from the industrial track and also much of the heavy form work. The concrete plant consists of a one cubic yard Smith mixer, a cement bin having a capacity of four carloads, and stone and sand bins. The stone and sand is elevated to the overhead bins by means of a bucket conveyor from a pit into which it is dropped from hopper cars. Cement was delivered in bulk and stored in separate bins, each having a one car capacity, where it remained until tested and was then transferred to the overhead bin by means of conveyors. In order to secure uniform mixes, the cement for each batch was weighed and the water, stone and sand measured. All machinery in the concrete plant was operated by electric motors with current furnished from the University power plant.